

We claim:

1. A method for producing a genetically modified organism  
of the *Blakeslea* genus, which method comprises the  
5 following steps
  - (i) transformation of at least one of the cells,
  - (ii) optional homokaryotic conversion of the cells  
obtained in step (i) to produce cells in which  
one or more genetic characteristics of the nuclei  
10 are all modified in an identical manner and said  
genetic modification manifests itself in the  
cells, and
  - (iii) selection and cultivation of the genetically  
modified cell or cells.
- 15 2. The method according to claim 1, **wherein** the cells are  
from fungi of the *Blakeslea trispora* species.
3. The method according to claim 1 or 2, **wherein** a vector  
or free nucleic acids are used in the transformation  
(i).
- 20 4. The method according to claim 3, **wherein** the vector  
employed in the transformation (i) is integrated into  
the genome of at least one of the cells.
5. The method according to claim 4, **wherein** the vector  
employed in the transformation (i) comprises a promoter  
25 and/or a terminator.
6. The method according to any of the preceding claims 3  
to 5, **wherein** a vector comprising the *gpd*, *pcarB*,  
*pcarRA* and/or *ptef1* promoter and/or the *trpC* terminator  
is employed in the transformation (i).

7. The method according to any of the preceding claims 3 to 6, **wherein** a vector comprising a resistance gene is employed in the transformation (i).
- 5 8. The method according to claim 7, **wherein** the vector employed in the transformation (i) comprises a hygromycin resistance gene (hph), in particular from *E. coli*.
9. The method according to any of the preceding claims 5 -  
10 8, **wherein** the gpd promoter has the sequence SEQ ID NO: 1.
10. The method according to any of the preceding claims 5 -  
8, **wherein** the trpC terminator has the sequence SEQ ID NO: 2.
- 15 11. The method according to any of the preceding claims 5 -  
8, **wherein** the tef1 promoter has the sequence SEQ ID NO: 35.
12. The method according to any of claims 6 to 11, **wherein**  
the gpd promoter and the trpC terminator are derived  
20 from *Aspergillus nidulans*.
13. The method according to any of claims 3 to 12, **wherein**  
the vector comprises the SEQ ID NO: 3.
14. The method according to any of the preceding claims,  
**wherein** the transformation (i) is carried out using  
25 agrobacteria, conjugation, chemicals, electroporation,  
bombardment with DNA-loaded particles, protoplasts or  
microinjection.

15. The method according to any of the preceding claims,  
**wherein** a mutagenic agent is employed in the  
homokaryotic conversion (ii).
16. The method according to claim 15, **wherein** the mutagenic  
5 agent employed is N-methyl-N'-nitronitrosoguanidine  
(MNNG), UV radiation or X rays.
17. The method according to any of the preceding claims,  
**wherein** the selection is carried out by labeling and/or  
selecting the mononuclear cells.
- 10 18. The method according to any of the preceding claims 1 -  
17, **wherein** 5-carbon-5-deazariboflavin (darf) and  
hygromycin (hyg) or 5-fluororotate (FOA) and uracil and  
hygromycin are employed in the selection.
- 15 19. The method according to any of claims 3 to 18, **wherein**  
the vector employed in the transformation (i) includes  
genetic information for producing carotenoids or their  
precursors.
- 20 20. The method according to any of claims 3 to 19, **wherein**  
the vector employed in the transformation (i) includes  
20 genetic information for producing carotenes or  
xanthophylls.
21. The method according to any of claims 3 to 20, **wherein**  
the vector employed in the transformation (i) includes  
genetic information for producing astaxanthin,  
25 zeaxanthin, echinenone,  $\beta$ -cryptoxanthin, andonixanthin,  
adonirubin, canthaxanthin, 3-hydroxyechinenone, 3'-  
hydroxyechinenone, lycopene,  $\beta$ -carotene,  $\alpha$ -carotene,  
lutein, bixin, phytofluene or phytoene.
- 30 22. The method according to any of claims 3 to 21, **wherein**  
the vector employed in the transformation (i) is

30. The method according to any of claims 3 to 21, **wherein** the lycopene cyclase gene is switched off due to the transformation.
- 5 31. A genetically modified multinuclear cell of the fungi of the Blakeslea genus, in particular Blakeslea trispora, obtainable by any of the preceding claims.
- 10 32. The use of the cells according to claim 30 or of a mycelium formed therefrom for producing carotenoids or their precursors.
33. The use according to claim 30 or 31 for producing carotenes or xanthophylls.
- 15 34. The use according to any of claims 30 to 32 for producing astaxanthin, zeaxanthin, echinenone,  $\beta$ -cryptoxanthin, andonixanthin, adonirubin, canthaxanthin, 3-hydroxyechinenone, 3'-hydroxyechinenone, lycopene,  $\beta$ -carotene,  $\alpha$ -carotene, lutein, 20 bixin, phytofluene or phytoene.
- 25 35. A promoter having the sequence SEQ ID NO: 1 or 35 for the use in the method according to any of claims 1 - 29.
36. A terminator having the sequence SEQ ID NO: 2 for the use in the method according to any of claims 1 - 29.
- 30 37. A vector comprising SEQ ID NO: 3 for the use in the method according to any of claims 1 - 29.
38. The vector according to claim 36 for the use in the method according to any of claims 1 - 29, comprising

SEQ ID NO: 69 and/or SEQ ID NO: 70 or 71 and/or 72 or  
76.